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HARDNESS INVESTIGATION ON WELDED JOINTS FABRICATED VIA BASIC FLUX COATED ELECTRODE WITH MANUAL METAL ARC WELDING

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ABSTRACT

Today, the Manual Metal Arc Welding has an important role in latest manufacturing, such as automobiles, aircraft, and high-pressure packing. This method is primarily used for construction, repair, and manufacturing activities using steel alloys. The advantages of MMAW are location capability, metallurgical benefits, and high-quality weld metal deposit. The setting of weld parameters, however, requires significant skills. The mechanical characteristics of joints are primarily dependent by the bead geometry and the weld microstructure influenced by MMAW methods of metal transmission and arc stability. This paper discusses the hardness of welded joints via a basic flux coated electrode with MMAW. Fifteen combinations of Basic flux coated electrode is manufactured and used for making welded joint under 90A and 100A of welding current. The result shows that when the amount of heat input increase, hardness decrease On the other hand, Hardness increases with increasing basicityindex (BI). The optimum Hardness for welding metal is produced by the welding electrode BE-10 at 90A with 185 HV while the lowest value is 175 HV (a decline of 11.6%) For BE-7 at100A

KEYWORDS: *Manual Metal Arc Welding (MMAW), Basicity Index (BI), Hardness, Basic Electrode (BE)*

INTRODUCTION

Welding is relevant because of its high joint performance, fast installation, versatility, and low manufacturing costs [1]. The welding process is efficient, durable, and cost-effective. Welded joints are used for vital components when disasters occur. Therefore, methods of inspection and conformity with appropriate requirements are growing. The minimum weld consistency, which is based on the examination of sold-containing specimens, is represented by the approval criteria The welding requires a broad variety and the properties of the welding wire, for example, time, temperature, electrode, the strength of the pulse and power induction as well as the welding speed[2-9]. Steel welding isn't quick at any time. To have a good welding efficiency, it is important to correctly choose welding parameters for a particular job. Welding is the permanent mechanism by which a mixture of temperature, pressure, and metallurgy results in the binding of two or more metals together to create a located coalescent coalescence [10]. As a result, the use of the control system in arc welding will remove much of the "guess work" sometimes done by welders to determine the welding parameters for a given task[11]. The mechanical properties of welded materials are greatly influenced by welding parameters. Currently, voltage uses, polarity, solder filler type, solder filler size, weight, electrode angle, arc travel distance, welding technique are the principal types of welding parameters. [12]. Shielded Metal Arc Welding (SMAW) is characterised as a welding process

that melts and joins metals between the welding filler (electrode rod) and the workpieces. The effect of the welding parameters (different type of electrode and current) on the reliability of high strength steel arc welded joints with MMAW has been studied in this study.

P. Kanjilal et al. have developed rotatable designs based on mathematical studies on mixtures to predict the combined effect of flux mixture and welding parameters on submerged arc welding chemical composition and mechanical properties. Bead-on-plate welding deposits on low carbon steel plates are made in a number of flux formulations and welding parameter combinations. The findings indicate that flux mixing related variables based on various flux materials and solder parameters have both individual and interactive effects on reactions, i.e. Mechanical characteristics of the welding metal composition and. V.M. V.M. Cabrera and S'anchez-Cabrera. Rubio-Gonz'alez conducted welding using two alternate methods, pre-heated and related filler materials or a pre-heating of the austenitic stainless steel filling metal. This investigation is intended to define and compare the impact on microstructure, fracturing strength and fatigue crack growth rates of the sold joint for these two alternatives. The first solution is to minimize internal residual pressure and the amount of the diffused hydrogen by a GMAW welding procedure and the equivalent filler wire. Secondly, the component is hydrogen amounts in the argon blinding gas for the purpose of diffusing hydrogen to the heating region using a GMAW welding procedure and austenitic stainless steel filler (greater hydrogen solubility). The findings demonstrate how mechanical properties influence the thermal cycle, varying amounts of hydrogen, and hydrogen trap.

Experimental Details

Figure: 1Shows the hardness test unit from Vickers The hardness that is the deformation resistance of the specimens is a measure of plastic or constant deformation resistance. In this analysis, the static indentation test was used to verify that the specimens of a ball indenter were hard on the specimens that were examined. The relationship between the overall test force and the indentation area or depth produces hardness measurements. The hardness measurements were carried out in accordance with the requirements of ASTM E10.

Figure 1: Vickers Hardness Testing Machine.

RESULTS AND DISCUSSIONS

The results on Vickers' hardness in the weld metal are seen in table 1 and 2 of the form of welding electrodes and welding present. For BE-10, the hardness is greater than the others. The figure 1 indicates the lowest average hardness of Vickers for the surface of about 175 HV in BE-7. The maximum average hardness value of BE-10 is roughly 198 HV. This is similar to many other researchers [17-20]. This finding is similar to science. Figures 1 and 2 show that the hardness will decline as the current rises The average value of hardness for Vickers falls from 185.75HV to 181.27 HV with the welding current increasing from 90A to 100A. The connection is that with the increased welding present, the heat input both increases and decreases the welding zone hardness and HAZ (Heat Influenced Zone). The heat input influences soldering's metallurgical output during solidification and the possibility of forming defects in various welding circumstances.If input energy increases, the growths of grain in the weld system increases and the grain limits in the past are decreased. Reduction of grain boundaries as locks for dislocation motions increases the potential and the number of dislocations as structural line defects. The lower efficiency of the weld current 100 A would reduce the power and the hardness of the weld metal [20]. At the same time, a cooling rate largely influences the welding microstructure. When the power demand is lower, it is not important to cool down rapidly and smaller grains are encouraged. Higher energy consumption, however, increases the required time for solidification and slows the cooling rate, resulting in gross grain. As the grain size increases when welding current, the mechanical characteristics such as hardness value, effect, and strength value of the tension are reduced [21]. As the consumption of heat energy was increased, the mechanical properties decreased in the ferrite matrix with a grain growth due to the microstructure of the coarse perlite [22].

Figure 1, 2 and Table 1, 2 Shows, it is obvious that Hardness increases with increase in Basicity index but at the same time it showed decrease with increase in welding current from 90A to 100A.Hardness is high in HAZ area compared to weld metal area.

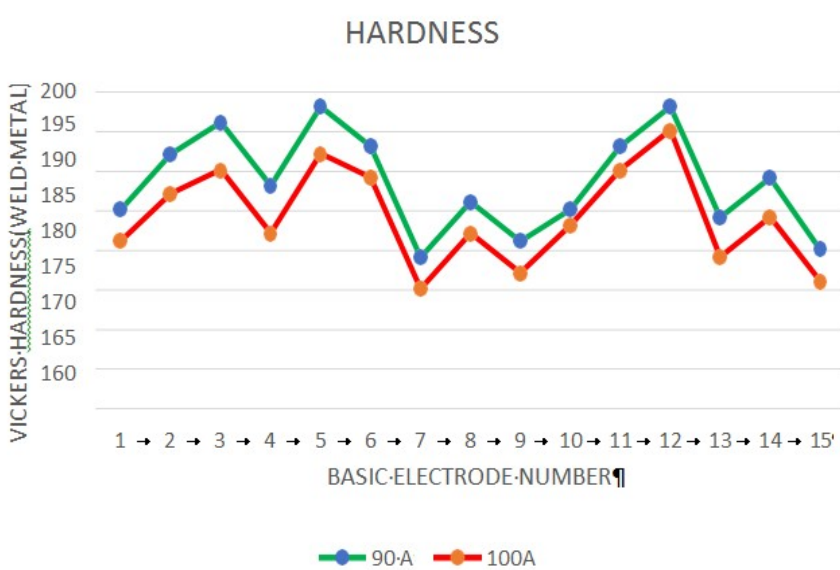

Figure 2: Hardness Values on Weld Area.

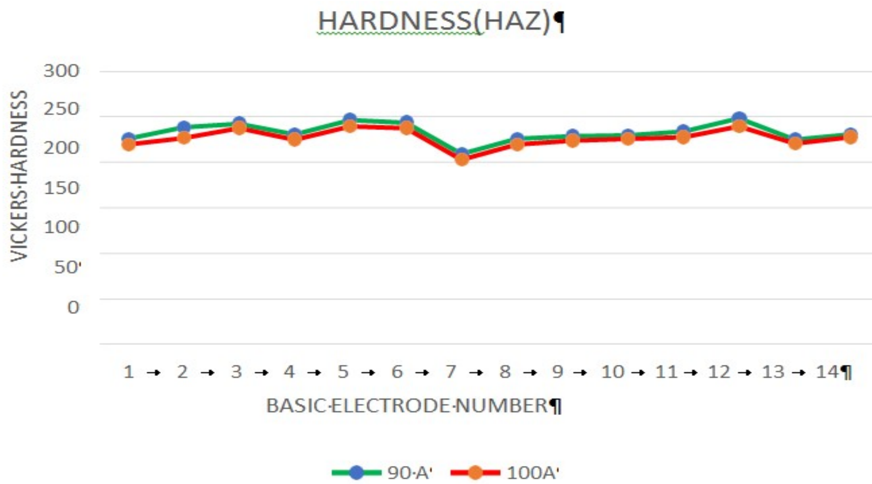

Figure 3: Hardness Values on HAZ.

Table 1: Vickers Hardness Test Results(Weld Metal)

Area	Basic Electrode(BE)	Welding Current A	Vickers Hardness Test(VH)
Weld Metal	BE-1	90	185
		100	181
	BE-2	90	192
		100	187
	BE-3	90	196
		100	190
	BE-4	90	188
		100	182
	BE-5	90	198
		100	192
	BE-6	90	193
		100	189
	BE-7	90	179
		100	175
	BE-8	90	186
		100	182
	BE-9	90	181
		100	177
	BE-10	90	185
		100	183
	BE-11	90	193
		100	190
	BE-12	90	198
		100	195
	BE-13	90	184
		100	179
	BE-14	90	189
		100	184
	BE-15	90	180
		100	176

Table 2: Vickers Hardness Test Results(Haz)

Area	Electrode	Welding Current A	Vickers Hardness Test(VH)
HAZ(Heat Affected Zone)	1	90	225
		100	219
	2	90	238
		100	226
	3	90	242
		100	237
	4	90	230
		100	224
	5	90	246
		100	239
	6	90	243
		100	237
	7	90	208
		100	202
	8	90	225
		100	219
	9	90	228
		100	223
	10	90	229
		100	225
	11	90	233
		100	227
	12	90	248
		100	239
	13	90	218
		100	213
	14	90	224
		100	220
	15	90	230
		100	227

CONCLUSIONS

This Works Concluded that

- There are significant effects of welding parameters (electrode type and heat input / welding current) on hardness of the welded metal on carbon steel through MMAWwelding.
- When the amount of heat input increase (shown by the current), hardness decrease On the other hand ,Hardness increases with increasing basicityindex(BI).
- The optimum Hardness for welding metal is produced by the welding electrode BE-10 at 90A with 185 HV while the lowest value is 175 HV (decline of 11.6%) For BE-7 at100A.
- In the HAZ, Hardness is greater than weld metal area.BE-12 Electrode produced hardness value of 248VH.

REFERENCES

1. *Armentani, E., Esposito, R., Sepe, R. (2007). The effect of thermal properties and weld efficiency on residualstresses in welding, Journal of Achievements in Materials and Manufacturing Engineering, Vol. 20, No. 1-2, 319–322.*
2. *Jariyaboon, M., Davenport, A.J., Ambat, R., Connolly, B.J., Williams, S.W., Price, D.A. (2007) The effect ofwelding parameters on the corrosion behaviour of friction stir welded AA2024-T351, Corrosion Science, Vol. 49, No. 2, 877–909,*
3. *.Karadeniz, E., Ozsarac, U., Yildiz, C. (2007). The effect of process parameters on penetration in gas metal arcwelding processes, Materials & Design, Vol. 28, No. 2, 649–656, doi: 10.1016/j.matdes. 2005.07.014*
4. *Lothongkum, G., Viyanit, E., Bhandhubanyong, P. (2001). Study on the effects of pulsed TIG welding parameters on delta-ferrite content, shape factor and bead quality in orbital welding of AISI 316L stainless steel plate, Journalof Materials Processing Technology, Vol. 110, No. 2, 233–238, do: 10.1016/S0924- 0136(00)00875-X.*
5. *Lothongkum, G., Chaumbai, P., Bhandhubanyong, P. (1999). TIG pulse welding of 304L austenitic stainless steel inflat, verticalandoverheadpositions,JournalofMaterialsProcessingTechnology,Vol.89–90,410- 414, doe: 10.1016/S0924-0136(99)00046-1.*
6. *Mirzaei, M., ArabiJeshvaghani, R., Yazdipour, A., Zangeneh-Madar, K. (2013) Study of welding velocityand pulse frequency on microstructure and mechanical properties of pulsed gas metal arc welded high strength low alloy steel,Materials& Design, Vol. 51, 709–713,*
7. *Sakthivel, T., Sengar, G.S., Mukhopadhyay, J. (2009) Effect of welding speed on microstructure andmechanical properties of friction-stir-welded aluminum, The Internation al Journal of Advanced Manufacturing Technology, Vol. 43,*
8. *Razal Rose, A., Manisekar, K., Balasubramanian, V. (2012). Influences of welding speed on tensile properties of friction stirweldedAZ61Amagnesiumalloy,JournalofMaterialsEngineeringandPerformance,Vol. 21, No. 2, 257–265,doi:*
9. *Afolabi, A.S. (2008). Effect of electric arc welding parameters on corrosion behaviour of austeniticstainless steelin chloride medium, AU Journal of Technology, Vol. 11, No. 3, 171–180*
10. *Khan, M.I (2007). Welding Science and Technology. New Age International. Pp.1-5.Lee, J. I., and K. W. Um. "A prediction of welding process parameters by prediction of back-bead geometry" Journal of materials processing technology 108.1 (2000):106-113. ESAB. (ND). ESAB Welding and Cutting Products-North America Retrieved from Handbook-WeldingTechniques*
11. *(Welding Parameter and Techniques) ASMEBoilerandPressureVesselCodeSectionIXWeldingandBrazingQualification, 2010.*
12. *KanjilalP,PalTK,MajumdarSK(2006)Combinedeffectoffluxandweldingparameters on chemical compositionand mechanical properties of submerged arc weld metal. J Mater Process Technol 171: 223–231.ChandelRS,SeowHP,CheongFL(1997)Effectofincreasingdepositionrateonthebead geometryof submerged arc welds. J Mater Process Technol 72:124–128.*

13. *Kolhe KP, Datta CK (2008) Prediction of microstructure and mechanical properties of multipass SAW. J MaterProcess Technol 197:241–249.*
14. *Bracarense, A. Q., and S. Liu. "Control of covered electrode heating by flux ingredients substitution" Welding and Metal Fabrication 62.5(1994).Sarian,S.A.,andL.A.DeVadia."AllWeldMetalDesignForAWSE10018M,E11018M And E12018MType Electrode." Welding Research Supplement (1999): 217–219*
15. *Talabi, SIa, et al. "Effect of welding variables on mechanical properties of low carbon steel welded joint." Advancesin Production Engineering & Management 9.4 (2014): 181–186.*
16. *Tahir, Abdullah Mohd, Noor AjianMohd Lair, and Foo Jun Wei "Investigation on mechanical properties of welded material under different types of welding filler (shielded metal arc welding)." AIP Conference Proceedings. Vol. 1958 No. 1. AIP Publishing, 2018.*
17. *Bahman, A.R. (2010). Change in Hardness, Yield Strength and UTS of Welded Joints Reduced in ST 37 Grade Steel Indian Journal of Science and technology, 1162–1164.*
18. *Asibeluo, I. S., and E. Emifoniye "Effect of Arc welding current on the mechanical properties of A36 carbonsteel weld joints" SSRG International Journal of Mechanical Engineering (SSRGIJME)–volume 2 (2015)*
19. *M V Venkatesan, N Murugan, B M Prasad, A Manickavasagam," Influence of FCA Welding Process Parameters on Distortion of 409M Stainless Steel for Rail Coach Building", JOURNAL OF IRON AND STEEL RESEARCH, INTERNATIONAL. 2013, 20(1):71–78*
20. *E.Taban,E.Deleu,A.Dhooge,E.Kaluc,"GasmetalarcweldingofmodifiedX2CrNi12 ferritic stainless steel"' Kovove Mater. 45 200767–74*
21. *P. Kanjilal, T.K. Pal, S.K. Majumdar, " Combined effect of flux and welding parameters on chemical composition and mechanical properties of submerged arc weld metal", Journal of Materials Processing Technology 171 (2006)223–231.*